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Perceived health in a population based sample of victims of the 1956 polio epidemic in the Netherlands

F Nollet, B Ivanyi, A Beelen, R J de Haan, G J Lankhorst, M de Visser

Objective: To investigate perceived health and its relation to residual paresis from polio, late onset neuromuscular symptoms following poliomyelitis (LSP), and sex, in a population based sample of polio survivors.

Methods: 350 subjects traced from the notification records of the Dutch 1956 polio epidemic received a mailed questionnaire on residual polio paresis and new neuromuscular symptoms. Perceived health was measured using the Nottingham health profile. Respondents with new muscle weakness and new neuromuscular symptoms were considered as cases with LSP.

Results: Health problems were perceived by 151 of the 260 respondents. Respondents with residual paresis had significantly more health problems than clinically recovered respondents for the Nottingham health profile category of physical mobility. The perceived health of respondents with LSP (45.5%) was significantly worse than that of respondents without LSP for all the health profile categories. Among the respondents with LSP, health status did not differ between those with residual paresis and those who had recovered, except for physical mobility. Female respondents with LSP reported worse health status than male respondents with regard to physical mobility and social isolation.

Conclusions: In this population based sample, health problems were frequently reported. They were mainly related to late onset neuromuscular symptoms following poliomyelitis, which were perceived by a substantial proportion of all polio survivors—not only subjects with polio residuals but also individuals who (subjectively) had recovered from polio.
severity of the acute polio episode, the residual pareses after recovery from polio, and questions regarding impairments, disabilities, and handicaps, during the stable period and at the present time. For the stable period, the questions referred to the situation in 1975, a period during which all subjects had reached adulthood, making recollection more reliable. The questionnaire did not contain any questions on comorbidity.

A Dutch validated version of the Nottingham health profile was used, consisting of 38 yes/no questions about six categories of normal living (the number of questions is given in parentheses): physical mobility (8), energy (3), pain (8), social isolation (5), emotional reactions (9), and sleep (5). For the Nottingham health profile, a total score was calculated by counting the number of questions with yes answers and calculating sum scores for each category by dividing the number of yes answers by the total number of questions in that category and multiplying the result by 100. This resulted in scores for the Nottingham health profile categories that ranged from 0 (no complaints) to 100 (answered yes to all questions).

Data analysis
For the purpose of this study, the questions from the questionnaire which provided information about residual pareses from polio and about currently experienced or increased muscle weakness and neuromuscular symptoms were used for the analysis. As the respondents did not undergo a physical examination, the assessment of whether they might have late onset neuromuscular symptoms following poliomyelitis (LSP) had to be made on the basis of the self reported symptoms. Correct identification of cases may be hampered if new symptoms are of a non-specific nature. However, new muscle weakness is usually accompanied by other neuromuscular symptoms. Therefore, respondents were only considered as cases of LSP if they reported new muscle weakness, together with at least one other new or currently increased neuromuscular symptom, compared with 1975. These neuromuscular symptoms were fatigue, muscle pain, muscle cramps, muscle twitches, joint pain, and cold intolerance.

For the statistical analyses we used the SPSS statistical software package (SPSS 10.0.5; SPSS Inc, Chigaco, Illinois, USA). Dichotomised variables were analysed with the χ² test. Ordinal data and non-normally distributed data were analysed by the Mann–Whitney U test, with correction for ties. An α level of p < 0.05 was used for all tests of significance.

RESULTS
Study population
The sample of 350 subjects had a mean (SD) age of 44.6 (7.0) years (range 39 to 79) and a male/female ratio of 1.3. Seventy four percent of these subjects responded (n = 260). The mean age of the respondents was 44.4 (6.7) years (range 39 to 77). The female response rate was 79% and the male response rate, 70%. The respondents, 137 men and 123 women (male/female ratio 1.1), had contracted paralytic poliomyelitis at a mean age of 5.4 (6.7) years (range 0 to 38). No information about residual paresis in the stable period was available for 29 respondents. The majority of these respondents either denied (n = 19) or could not recall (n = 8) having had polio, and had therefore only answered the questions about their present status. Two respondents did not answer the question about residual paresis. Residual paresis of bulbar muscles, trunk muscles, or extremities in the stable period was reported by 144 (62%) of the 231 respondents who had answered these questions. No residual paresis of any extremity was reported by 50% of the respondents, while 33% had residual paresis of one extremity, 12% of two extremities, 2% of three extremities, and 1% of all extremities.

The age at the acute polio episode, the presence of residual paresis, and the number of extremities with residual paresis did not differ between male and female respondents.

Perceived health status
In 38 cases (15%) the total Nottingham health profile score and a varying number of category scores could not be calculated owing to missing values. The percentage of missing values per item ranged from 0.8% to 5.4%. The median total Nottingham health profile score (with 25th and 75th centile scores in parentheses) was 2 (0.7); in 151 respondents (68% of valid cases) the total score was above zero and the median total score of these subjects was 5 (2.10). There were 11 respondents who scored above zero in all categories. The percentages of respondents who scored above zero—indicating that they perceived health problems in that category—were 49% for physical mobility, 32% for energy, 35% for pain, 13% for social isolation, 40% for emotional reactions, and 34% for sleep. For each profile category, the distributions of scores were skewed, with a decrease in numbers towards higher scores (fig 1).

Perceived health status and residual paresis
Information about residual paresis was available from 231 respondents. The physical mobility score of the Nottingham health profile was significantly higher for respondents reporting residual paresis from polio during the stable period than for respondents with no residual paresis. No differences were found for any other category, and the median value for all the other categories was zero for both groups (table 1).

Perceived health status and late symptoms of polio
In three respondents (two male, one female) the presence of LSP could not be determined as they had not answered the question on whether or not their neuromuscular symptoms were increasing. New muscle weakness was reported by 135 respondents and new neuromuscular symptoms by 159; both were strongly associated (χ² test, p < 0.001). LSP was experienced by 117 (45.5%) of the 257 respondents, and the prevalence did not differ between male (46%) and female respondents (45%). LSP was experienced by 73 respondents with residual paresis (51%), and by 33 with no residual paresis (38%) (NS).

The scores for all Nottingham health profile categories were significantly higher in respondents with LSP than in those without LSP (table 2). In respondents with LSP the highest median scores were found for the categories of physical mobility, energy, and pain. Among the respondents with LSP, those with residual paresis from polio scored significantly higher than those reporting no residual paresis from polio only for physical mobility (table 3).

Perceived health status and sex
Female respondents scored significantly higher than male respondents in the categories physical mobility (p = 0.02), energy (p = 0.006), and social isolation (p = 0.007) (fig 1). In the subgroup of respondents with LSP, the female respondents had significantly higher scores in the categories of physical mobility and social isolation than the male respondents (table 4). The score for the category of energy was higher for female respondents with LSP than for male respondents, although this difference was not significant (p = 0.06).

DISCUSSION
In this study of a population based sample of polio survivors, the majority (151) of the 260 respondents perceived health problems, as measured by the Nottingham health profile, 39 years after acute paralytic poliomyelitis. Given the fact that we were not allowed to follow up the non-responders, the response rate of 74% was high. Judged by age the respondents...
seemed to be representative of the sample studied, although
the response rate was somewhat lower for men than for
women.

Although a reference sample of the general population was
not available for a comparison, it seems unlikely that the per-
ceived health status in the study population had not
worsened. Only 32% of the respondents scored zero on all
items, which is less than the 35% and 60%, respectively, of
respondents with a total Nottingham health profile score of
zero found in community surveys of adults of all ages,19 20
and also less than the reported 46% of middle aged to elderly
people with a total Nottingham health profile score of zero.21
From the category scores it appears that the smaller percent-
age of respondents with a total score of zero in the study
population reflects the larger number of respondents with
scores above zero in the categories of physical mobility, energy,
and pain in comparison with general community population
samples, which reported zero scores in these categories in
approximately 80% of the respondents.19 21 23 In studies of
patients with postpoliomyelitis syndrome, these Nottingham
profile categories have also shown the highest problem
scores.45 For each of the other three categories—social
isolation, emotional reactions, and pain—the percentage of
respondents with zero scores was within the range reported in
those studies. Furthermore, it must be acknowledged that the
ability of the Nottingham health profile to detect low levels of
ill health may be limited compared with other clinimetric
scales,21–23 and the Nottingham instrument measures a limited
number of areas of functioning.24 25 Moreover, it may underes-
timate problems in some subjects, for example if a person is
wheelchair bound.

The Nottingham health profile was incompletely answered
by 15% of the respondents—a surprisingly high proportion
given that the questionnaire is supposed to be simple and eas-
ily understood.25 Missing values may in part reflect the
method of data collection, as our missing value rates were

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**Figure 1** Histogram of Nottingham health profile scores for all respondents and for male and female respondents.
comparable with those from another study using a mailed questionnaire. It may also be that the Nottingham health profile is not that simple to answer, because people sometimes have difficulty in answering questions that require only a yes or a no, as has been observed by interviewers. Although one can only speculate, it seems likely that the missing values in the study bias the results towards an underestimation of health problems, because it may be expected that some questions were left unanswered when subjects doubted whether the problem was fully applicable to them.

Health status was further examined for different subgroups of respondents. In accordance with the expectation, respondents with physical limitations from residual polio paresis scored higher for physical mobility. However, pain or lack of energy were unrelated to the polio residuals, and the polio residuals did not influence social functioning, emotional reactions, or sleep. The study population was also divided with respect to new neuromuscular symptoms. The health status of respondents with LSP was highly significantly worse for all Nottingham health profile categories in comparison with the health status of those who did not complain about new neuromuscular symptoms, including muscle weakness. The areas of functioning, physical mobility, energy, and pain were the most compromised among the LSP respondents, which is in accordance with the results from hospital based studies of former polio patients with new neuromuscular symptoms. Major psychopathology has not been found among polio patients with new symptoms. However, although the scores for the Nottingham health profile categories of social isolation, emotional reactions, and sleep—which relate to aspects of psychological and social functioning—were generally low, they were significantly higher for the respondents with LSP than for those without LSP. This might be related to emotional distress resulting from increasing disabilities but could also be a result of uncertainty about the possible effects of their former illness in this population based study group.

Some selection bias may be assumed owing to the non-specific nature of symptoms, which are also found in the general population, though they were far more frequent among the polio subjects. However, in contrast to the sample

### Table 1 Perceived health in respondents with residual paresis from polio and respondents with no residual paresis

<table>
<thead>
<tr>
<th>NHP category</th>
<th>Residual paresis (N=144)</th>
<th>No residual paresis (N=87)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical mobility</td>
<td>12.5 (0;31.3)</td>
<td>0 (0; 12.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Energy</td>
<td>0 (0.33 3)</td>
<td>0 (0; 33.3)</td>
<td>0.52</td>
</tr>
<tr>
<td>Pain</td>
<td>0 (0.37 5)</td>
<td>0 (0; 12.5)</td>
<td>0.07</td>
</tr>
<tr>
<td>Social isolation</td>
<td>0 (0; 0)</td>
<td>0 (0; 0)</td>
<td>0.51</td>
</tr>
<tr>
<td>Emotional reactions</td>
<td>0 (0.11 1)</td>
<td>0 (0; 11.1)</td>
<td>0.48</td>
</tr>
<tr>
<td>Sleep</td>
<td>0 (0; 20)</td>
<td>0 (0; 20)</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Values are median (25th and 75th centile scores); total number of respondents (N) and number who responded per category (n).

NHP, Nottingham health profile.

### Table 2 Perceived health in respondents with and without late onset neuromuscular symptoms following poliomyelitis (LSP)

<table>
<thead>
<tr>
<th>NHP category</th>
<th>LSP (N=117)</th>
<th>No LSP (N=140)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical mobility</td>
<td>25 (0.37 5)</td>
<td>0 (0; 12.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Energy</td>
<td>33.3 (0.66 7)</td>
<td>0 (0; 0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pain</td>
<td>25 (0.62 5)</td>
<td>0 (0; 0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Social isolation</td>
<td>0 (0; 0)</td>
<td>0 (0; 0)</td>
<td>0.02</td>
</tr>
<tr>
<td>Emotional reactions</td>
<td>11.1 (0.22 2)</td>
<td>0 (0; 11.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sleep</td>
<td>0 (0; 20)</td>
<td>0 (0; 0)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Values are median (25th and 75th centile scores); total number of respondents (N) and number who responded per category (n).

NHP, Nottingham health profile.

### Table 3 Perceived health for respondents with late onset neuromuscular symptoms of polio (LSP) and residual paresis and for respondents with LSP and no residual paresis

<table>
<thead>
<tr>
<th>NHP category</th>
<th>LSP and residual paresis (N=73)</th>
<th>LSP and no residual paresis (N=33)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical mobility</td>
<td>25 (12.5; 50)</td>
<td>12.5 (0; 25)</td>
<td>0.01</td>
</tr>
<tr>
<td>Energy</td>
<td>0 (0.66 7)</td>
<td>33.3 (0; 66.7)</td>
<td>0.64</td>
</tr>
<tr>
<td>Pain</td>
<td>25 (0.68 8)</td>
<td>12.5 (0; 50)</td>
<td>0.29</td>
</tr>
<tr>
<td>Social isolation</td>
<td>0 (0; 0)</td>
<td>0 (0; 15)</td>
<td>0.25</td>
</tr>
<tr>
<td>Emotional reactions</td>
<td>11.1 (0.22 2)</td>
<td>11.1 (0.27 8)</td>
<td>0.97</td>
</tr>
<tr>
<td>Sleep</td>
<td>0 (0; 20)</td>
<td>20 (0; 20)</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Values are median (25th and 75th centile scores); total number of respondents (N) and number who responded per category (n).

NHP, Nottingham health profile.
Tend to minimise their symptoms and therefore limited needs to be interpreted with care as our respondents were not sympotms in the respondents with residual paresis. This was true muscular symptoms, but the impact of these in terms of percentage of the recovered respondents report new neuromuscular symptoms, as determined by manual strength testing, residuals may be present in apparently fully recovered muscle groups, as determined by imaging techniques. However, an insidious progressive strength loss may be occurring in some subjects which may only be detected over a period of many years. Thus it would be interesting to follow up a large unselected group of polio subjects prospectively with annual measurements, in order to investigate the influence of new symptoms, comorbidity, and aging on functional status.

More than female polio victims were reported in 1956, which is in accordance with other observations of a higher incidence of polio in men than in women.

Although the response rate of the male subjects was somewhat lower than the female response rate, no differences were found in the prevalence of new muscle weakness between men and women.

Interestingly, the perceived health of the women appeared to be significantly worse in the Nottingham health profile categories of physical mobility, energy, and social isolation. Sex differences in the Nottingham health profile scores were also found for respondents with LSP. Why substantially greater numbers of female patients with postpoliomyelitis syndrome consult polio clinics remains puzzling. It may partly reflect a sex difference in problem perception, or it may be that women are more prepared to face the consequences of the new symptoms.

Conclusions

This is the first study to investigate the health status of a population based sample of polio subjects with a generic validated questionnaire, the Nottingham health profile. Perceived health problems were often reported and the areas in which problems were perceived were in agreement with those of polio patients attending health care facilities. Health problems were mainly related to the presence of late onset neuromuscular symptoms following poliomyelitis. New health problems may be expected among polio survivors with new neuromuscular symptoms, not only in subjects with residual paresis but also in those who appear to have made a good recovery.

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